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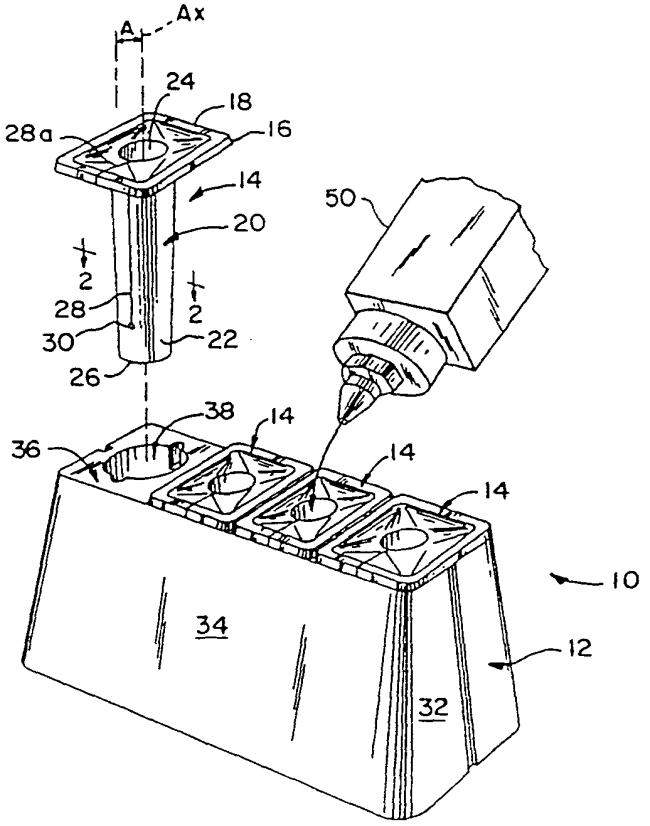
(54) Title: HOT-MELT ADHESIVE RECYCLING SYSTEM AND METHOD

(57) Abstract

A system and method for recovering hot-melt materials for reuse in a glue gun (50) includes a flexible mold form (14) mounted in a carrier (12) and having an internal cavity that approximates the dimensions of the preformed hot-melt sticks (S). In order to change from one type of hot-melt material to another, the sticks (S) of the desired material are loaded into the glue gun (50) while the heated, hot-melt material in the gun (50) is discharged into the mold form (14). The hot-melt material flows into the mold form (14) and assumes the shape of a conventional preformed stick (S). After cooling and solidification of the material, the mold form (14) is removed from its carrier (12) and the cooled, cast stick (S) is removed from the mold form (14) for reuse. The mold form (14) is fabricated from a flexible, heat-resistant material, such as a silicone rubber, and includes an elongated tube-like portion (20) having a tapered exterior surface (22) to facilitate removal from its carrier (12) and an internal bore dimensioned to produce a cast stick (S) having the dimensions of the preformed stick.



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HOT-MELT ADHESIVE RECYCLING SYSTEM AND METHOD

Technical Field

The present invention relates to hot-melt adhesives and, more particularly, to the recycling of hot-melt adhesives and similar thermoplastic materials commonly used in electric hot-melt adhesive dispensing guns.

Background Art

Hot-melt adhesive dispensing guns, commonly known as glue guns, have achieved widespread use in the consumer market where they are used to effect common household repairs. The guns typically include a body portion having an internal electric heater and an integral handle that is grasped by the user. Solid adhesive or caulking materials in the form of short, cylindrical sticks are loaded into the gun through an entry port and melted by the heater for discharge through a nozzle. The sticks are typically 5.1 cm. (two inches) or 10.2 cm. (four inches) in length and 12.7 mm. (0.5 inches) in diameter. A typical gun has the internal capacity to accommodate the volumetric equivalent of two to four 5.1 cm. sticks in a molten state for discharge through the nozzle. In order to change from one type of thermoplastic material, e.g., from a traditional adhesive to a caulking material, the contents of the gun must first be purged. This can be accomplished by loading the gun with two or three sticks of the desired material and continuously discharging the hot contents of the gun until the internal passages and cavities of the gun are purged of the former material and filled with the desired material. As can be appreciated, frequent changeover from one material to another is both time consuming and wasteful, and the inconvenience associated with a changeover limits the variety of materials that can be used with traditional hot-melt glue guns. While hot-melt adhesives can be fabricated in different compositions for different purposes, for example, adhesives for adhering cloth, stone, metal, glass, etc., and caulks in different colors or compositions, the waste associated with the need to purge the prior contents of the gun represents a

practical limit of the ability to market a wide variety of adhesive and caulk compositions.

Disclosure of Invention

The present invention provides a system and method for the recovery of hot-melt materials discharged from hot-melt dispensing guns as a consequence of changeover from one type of material to another and recycling of the recovered material in stick form for reuse.

A mold apparatus includes a mold form having an internal cavity that approximates the dimensions of the preformed hot-melt sticks and which is fabricated from a flexible material that does not adhere to the various hot-melt materials. A carrier is provided to support the mold form during the recovery of the hot-melt material. As part of the process of purging a glue gun, the solid, preformed sticks of the desired material are loaded into the gun while the heated, undesired hot-melt material is discharged into the mold form. The hot-melt material flows into the mold form and assumes the shape of a conventional preformed stick. After cooling and solidification of the material, the mold form is removed from its carrier, and the cooled stick is separated from the flexible mold form for reuse.

The mold form is preferably fabricated from a flexible, heat-resistant material, such as a silicone rubber, and includes an elongated tubular portion having a preferably tapered exterior and a cylindrical internal bore dimensioned to produce a cast stick having the dimensions of a conventional preformed stick. A flange is formed at one end of the mold form to allow the mold form to be inserted into the receiving opening of a carrier designed to carry a plurality of mold forms, the number of mold forms being desirably sufficient to accommodate the entire internal capacity of the glue gun during changeover from one type of hot-melt material to another.

The present invention advantageously addresses the problem of recycling hot-melt material purged from a glue gun when changing-over from one type of hot-melt material to another and, from a practical standpoint, allows for

the marketing of a wider variety of specialized hot-melt materials.

Brief Description of Drawings

The present invention will now be described, by way of example, with reference to the accompanying drawings, wherein:

FIG. 1 is a perspective view of a hot-melt recycling system in accordance with the present invention illustrating an exemplary four-stick mold form carrier;

FIG. 2 is a detailed cross-sectional view of a mold form taken along line 2-2 of FIG. 1; and

FIG. 3 is a vertically exploded view of a mold form removed from its carrier and a cast hot-melt material stick suitable for reuse in a hot-melt dispensing gun.

Best Mode for Carrying Out the Invention

An exemplary hot-melt recycling system in accordance with the present invention is shown in FIG. 1 and designated generally therein by the reference character 10. As shown, the system 10 includes a base-like carrier 12 and a plurality of mold forms 14 of which one is shown removed from the carrier 12 for reasons of clarity. Each mold form 14 includes a generally rectangular flange 16 at one end defined by a peripheral rim 18. A tube-like portion 20 extends downwardly from the flange 16 and, as shown in FIGS. 2 and 3, includes a wall portion defined by an outer surface 22, an inner surface 24, and a closed bottom end 26. The outer surface 22 is a surface of revolution about the longitudinal axis A_X of the mold form 14 and is formed so as to taper relative to the axis A_X, an angle A of 8° being preferred for a total included angle of 16°. Accordingly, the outer surface 22 defines a truncated cone that converges in the direction of the bottom end 26. The inner surface 24 is formed as a cylindrical surface of revolution about the axis A_X and has a nominal diameter of about 12.7 mm. (0.5 inches) and an overall length of about 5.1 cm. (two inches), these dimensions being consistent with those used for preformed adhesive and caulk hot-melt sticks commonly used in consumer glue guns. The tube-like portion 20 is provided

with a slit 28 on one side along a major portion of its length with the slit 28 terminating in a small, circular stress-relief bore 30. The slit 28 is continuous through the flange 16 as indicated at 28a in FIG. 1. The mold form 14 is fabricated from a flexible, temperature resistant material that has a low surface adhesion to the range of available hot-melt materials. In general, a flexible RTV-type silicone is preferred, although other functionally equivalent materials are also suitable. Additional disclosure as to the appearance of the mold form 14 is provided in co-filed and commonly owned U.S. Design Patent Application Serial No. 07/082,711 entitled "Mold Form or Similar Article," the disclosure of which is incorporated herein by reference.

The carrier 12 includes end and side walls 32 and 34 and an upper support surface 36 that includes an opening 38 for each of the mold forms 14. As shown in the cross-sectional view of FIG. 3, the carrier 12 is formed with an interior, downwardly converging conical section 40 that has an inner surface 42 formed as a surface of revolution about the axis A_X that defines a cavity that is dimensioned to receive the mold form 14 in a resilient line-to-line fit. As shown in FIG. 3, the conical section 40 is open at its bottom end has a rim 44 at its lower end that is dimensioned to allow the bottom end 26 of the mold form 14 to extend or project therebelow to allow each mold form 14 to be pushed out of the carrier 12 by application of a force in the direction of the arrow 46. Additional disclosure as to the appearance of the carrier 12 and variations thereof is provided in co-filed and commonly owned U.S. Design Patent Application Serial No. 07/082,710 entitled "Thermoplastic Casting Device or Similar Article," the disclosure of which is incorporated herein by reference.

In order to use the system 10 of FIGS. 1 - 3 to recover and recycle hot-melt materials, the mold forms 14 are mounted in their carrier 12 and a hot-melt dispensing gun 50 is positioned to discharge its supply of hot-melt material, e.g., an adhesive or a caulk, in the open top of

the mold form 14. The hot, viscous material enters the mold form 14 and accumulates to fill the cavity defined by the inner surface 24 and the bottom end 26 of the mold form 14. The heat conductivity of the typically silicone material is such to conserve heat and thus insure complete filling of the mold form 14. Since most commercial hot-melt dispensing guns have an internal capacity equivalent to four preformed sticks, the hot-melt dispensing gun 50 is used to fill all four mold forms 14. The hot material is then allowed to cool and solidify, a 30 to 60 minute cooling period at room temperature generally being sufficient. After the recovered material has solidified, the carrier 12 is grasped with one hand and one or more of the mold forms 14 are removed by applying a force, e.g., for example, with the fingers of the other hand, to the bottom ends 26 of the mold forms 14 to push them upwardly and out of the carrier 12. Thereafter, the portions of the flange 16 on the opposite sides of the slit 28 are pulled to separate the flexible sides of the mold form 14 to allow a cast stick S (FIG. 3) to be pulled from the mold form 14. As can be appreciated, the stick S is properly dimensioned for reuse in the hot-melt dispensing gun 50.

The present invention advantageously addresses the problem of recycling hot-melt material purged from a glue gun when changing-over from one type of hot-melt material to another and eliminate the waste often associated with changeover.

Claims:

1. A hot-melt material recycling system for the recovery of hot-melt material and the forming of the recovered material into solid preforms (S), the system characterised by a hot-melt dispensing apparatus (50) for receiving a solid hot-melt material preform (S), heating the preform (S) to a flowable state, and dispensing the heated material therefrom; a flexible mold form (14) for receiving the hot-melt material dispensed from the hot-melt dispensing apparatus (50) and molding the dispensed material into a hot-melt material preform (S) suitable for reuse in the hot-melt dispensing apparatus (50); and a mold carrier (12) for holding the flexible mold form (14).

2. The recycling system as in claim 1, the flexible mold form (14) characterised by a wall portion having an interior surface (24) and an exterior surface (22), the interior surface (24) defining a cylindrical cavity about a longitudinally extending axis (A_X), the cylindrical cavity having an open end for receiving the dispensed hot-melt material and having a closed end (26).

3. The recycling system as in claim 2, the wall portion characterised by a longitudinally extending slit (28) along a side thereof.

4. The recycling system as in claim 3, the wall portion characterised by a longitudinally extending slit (28) along a side thereof, the slit (28) terminated at one end by a bore (30) to relieve the stress at that end.

5. The recycling system as in claim 3 or 4, characterised in that the longitudinally extending slit (28) terminates intermediate the open and closed ends of the cylindrical cavity.

6. The recycling system as in claim 2, 3, 4, or 5, the flexible mold form (14) characterised by a peripheral

flange (16) extending about the open end thereof.

7. The recycling system as in claim 2, 3, 4, 5, or 6, the exterior surface (22) of the wall portion of the mold form (14) defining a conical surface of revolution about the longitudinally extending axis (A_x).

8. The recycling system as in claim 2, 3, 4, 5, or 6, the exterior surface (22) of the wall portion of the mold form (14) defining a conical surface of revolution about the longitudinally extending axis (A_x), the conical surface having an included angle of about 16°.

9. The recycling system as in claim 3, the mold carrier (12) characterised by a base member including a cavity having an opening (38) for receiving the flexible mold form (14), the cavity shaped to receive the exterior surface (22) of the flexible mold form (14).

10. The recycling system as in claim 9, the mold carrier characterised by a base member including a cavity having an opening (38) for receiving the flexible mold form (14), the cavity shaped to receive the exterior surface (22) of the flexible mold form (14) and constricts the longitudinal slit (28) so as to seal the flexible mold form (14), the cavity having another opening at the opposite end thereof through which the flexible mold form (14) is accessible.

11. The recycling system as in claim 2, the mold carrier (12) characterised by a base member including a conically shaped cavity having an opening (38) for receiving the flexible mold form (14).

12. The recycling system as in claim 2, the mold carrier (12) characterised by a base member including a conically shaped cavity having an opening (38) for receiving the flexible mold form (14), the cavity having another opening through which the flexible mold form (14)

portion defines a cylindrical cavity formed about a longitudinally extending axis (A_x).

17. The apparatus as in claim 13 or 14, characterised in that an exterior surface (22) of the wall portion defines a conical surface of revolution about the longitudinally extending axis (A_x).

18. The apparatus as in claim 13 or 14, characterised in that the exterior surface (22) of the wall portion defines a conical surface of revolution about the longitudinally extending axis (A_x), the conical surface having an included angle of about 16^o.

19. The apparatus as in claim 13 or 14, characterised in that the slit (28) is terminated by a bore (30) for relieving stress at that end.

20. The apparatus as in claim 13 or 15, the mold carrier (12) characterised by a base member including a conically shaped cavity having an opening (38) for receiving the flexible mold form (14).

21. The apparatus as in claim 13 or 15, the mold carrier (12) characterised by a base member including a conically shaped cavity having an opening (38) for receiving the flexible mold form (14), the cavity having another opening through which the flexible mold form (14) is accessible.

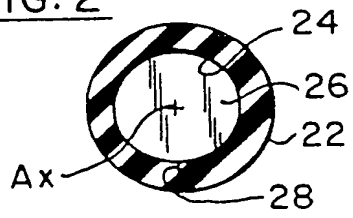
22. A recovery method for hot-melt material, characterised by the steps of dispensing residual hot-melt material contained in a hot-melt dispensing apparatus into a carrier-held flexible mold form (14) having an internal cavity dimensioned so as to form a hot-melt preform stick (S); allowing the dispensed hot-melt material to cool sufficiently to a hardened condition; removing the mold form (14) from the carrier (12); and deforming the flexible mold form (14) to a degree sufficient to enable

removal of the cooled preform stick (S) from the flexible mold (14).

23. A method of changing over from a first hot-melt material in a hot-melt dispensing apparatus (50) to a second hot-melt material and recovering the first hot-melt material for subsequent reuse, the hot-melt dispensing apparatus (50) of the type utilizing hot-melt material in solid stick (S) form loaded through an entry port (20), characterised by the steps of loading hot-melt material of the second type in stick form through the entry port (20) of the hot-melt dispensing apparatus and dispensing the heated and fluid residual hot-melt material of the first type contained in the hot-melt dispensing apparatus (50) into a flexible mold form (14) having an internal cavity dimensioned so as to form a hot-melt stick (S) suitable for subsequent reuse in the hot-melt dispensing apparatus (50); cooling the dispensed hot-melt material of the first type to form a solid stick (S) suitable for reuse in the hot-melt dispensing apparatus (50); and removing the solid stick (S) of the first type from the flexible mold (14).

24. The method of claim 23, the removing step further characterised by deforming the flexible mold form (14) to a degree sufficient to enable removal of the solid stick (S) therefrom.

FIG. 2



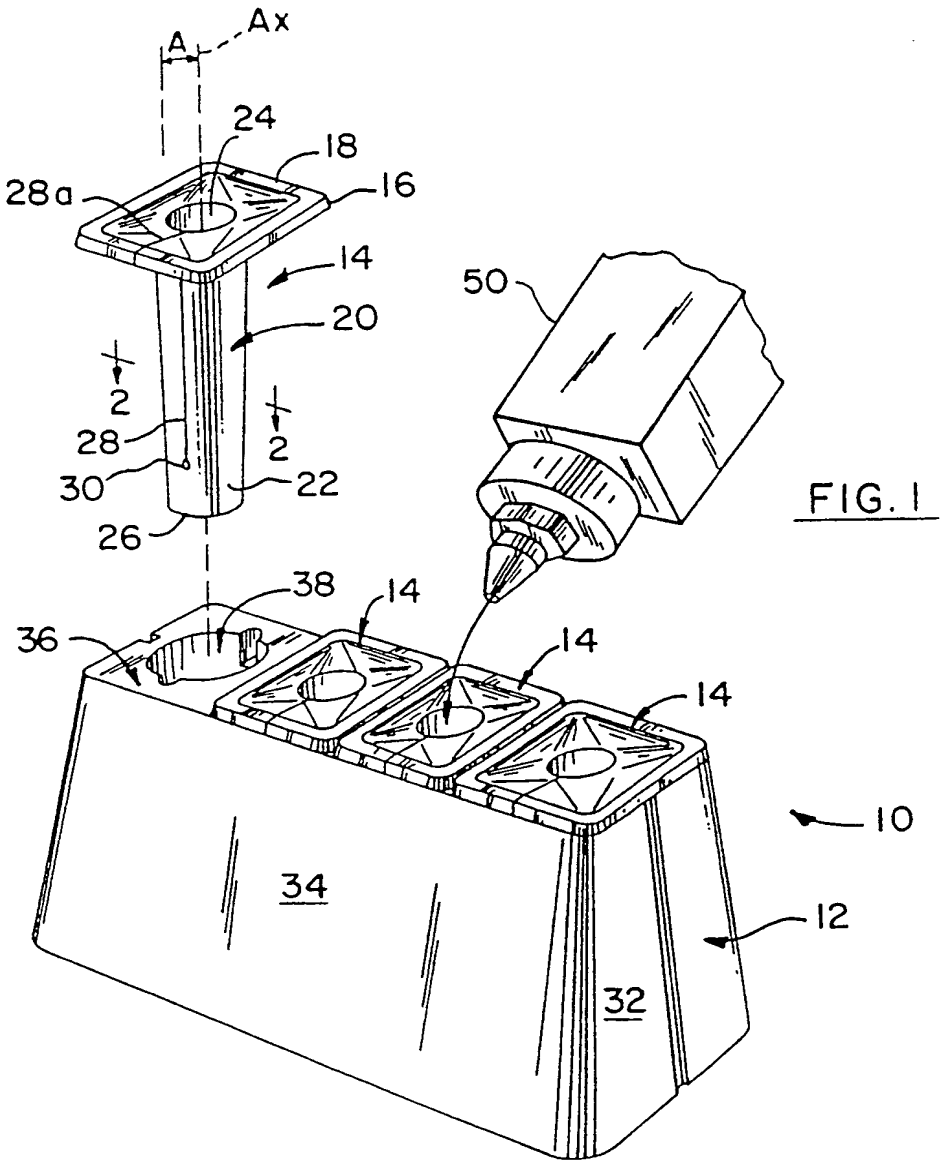
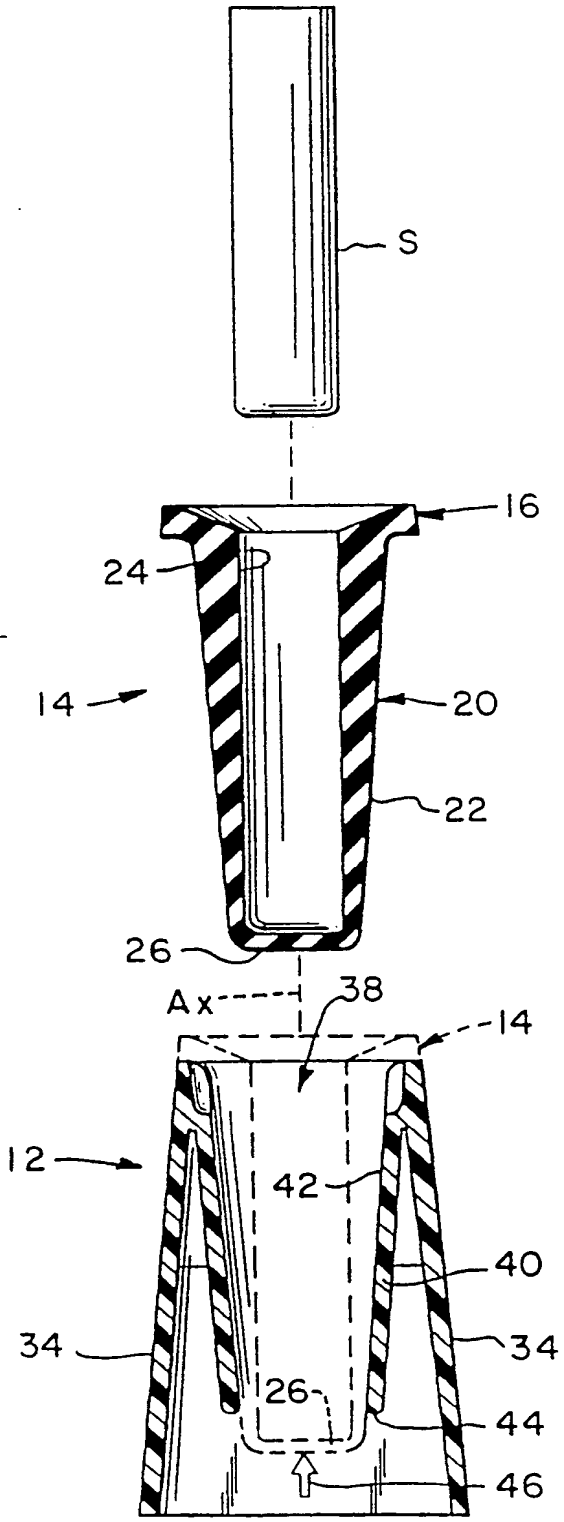


FIG. 1

FIG. 3



INTERNATIONAL SEARCH REPORT

International Application No PCT/US88/02655

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) [6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC[4]: B 05 B 15/04; B 05 C 11/10; B 05 C 21/00; B 29 B 17/00; B 29 C 33/44

II. FIELDS SEARCHED

Minimum Documentation Searched [7]

Classification System	Classification Symbols
IPC[4]	B 05 C; B 05 D; B 29 D; B 29 C; F 25 C

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched [8]

III. DOCUMENTS CONSIDERED TO BE RELEVANT [9]

Category [10]	Citation of Document, [11] with indication, where appropriate, of the relevant passages [12]	Relevant to Claim No. [13]
A	EP, A, 0111850 (NORDSON CORPORATION) 27 June 1984 see abstract --	1-24
A	US, A, 3679167 (JUPITER et al) 25 July 1972 see abstract --	14
A	US, A, 2712224 (J H ROETHEL) 5 July 1955 see claim 1 --	1-24
A	DE, A1, 2550792 (HOF, ALFONS) 18 May 1977 see page 5 --	1-24
A	US, A, 3712777 (SHERER) 23 January 1973 see abstract --------	1-24

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IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
28th October 1988	28 NOV 1988
International Searching Authority	**Signature of Authorized Officer**
EUROPEAN PATENT OFFICE	P.C.G. VAN DER PUTTEN

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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/US88/02655 SA 24009

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A1- 0111850	27/06/84	JP-A- 59123559	17/07/84
		CA-A- 1212087	30/09/86
		AU-A- 561288	07/05/87
US-A- 3679167	25/07/72	None	
US-A- 2712224	05/07/55	None	
DE-A1- 2550792	18/05/77	None	
US-A- 3712777	23/01/73	US-A- 3824298	16/07/74

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